EFFECTS OF EXPLICIT AND IMPLICIT FRIENDSHIP ATTITUDES ON APPRAISALS AND CARDIOVASCULAR REACTIVITY DURING A NEGATIVE EVENT DISCUSSION

by

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ABSTRACT

Decades of research provides evidence that social relationships are powerful predictors of health and mortality. One important moderator of the link between relationships and health is relationship quality, with supportive relationships often attenuating, and ambivalent relationships amplifying, reactivity that can cause wear-and-tear on the cardiovascular system. While much work has examined self-report (explicit) attitudes regarding relationship quality and links to cardiovascular reactivity (CVR), no study to our knowledge has examined whether implicit attitudes have similar or different effects. The current study examined whether implicit friendship attitudes influenced cognitive appraisals and cardiovascular reactivity during a negative event discussion. Based on prior work, we predicted interacting with friends rated as either explicitly or implicitly supportive would reduce CVR, as well as increase perceptions of control, and decrease perceptions of threat and stress associated with the speaking task. However, when interacting with a friend rated as either explicitly or implicitly ambivalent, we predicted a pattern similar to what we have traditionally seen with explicitly-rated ambivalent ties to emerge, such that participants would experience increased CVR, lower perceptions of control, and higher perceptions of threat and stress associated with the speaking task. Results did not support these hypotheses and unexpectedly, demonstrated some effects opposite to what was anticipated based on prior work. We consider several study limitations that shed light on these unexpected results, as well as discuss cognitive

organization theories that may be relevant in thinking about implicit friendship attitudes and possible links to health in future work.

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INTRODUCTION

Social Relationships and Health

The positive associations between social relationships and health have been well documented (Berkman, 1995; House, Landis, & Umberson, 1988; Uchino, 2009). Epidemiological studies specify links between social support and mortality related to cardiovascular disease (Brummett et al., 2001; Rutledge et al., 2004), cancer (Ell et al., 1992; Hibbard & Pope, 1993; Welin et al., 1992), as well as infectious disease (Lee & Rotheram-Borus, 2001; Patterson et al., 1996). In fact, a recent metaanalysis showed having strong social relationships was associated with a 50% increased chance of survival compared to those who were less socially integrated (Holt-Lunstad, Smith, & Layton, 2010). Holt-Lunstad et al. (2010) provide evidence that the magnitude of this effect is comparable to smoking cessation, while also exceeding well-known mortality risk factors, such as physical inactivity and obesity (also see House et al., 1988). Consistent with these epidemiological literatures, positive social interactions decrease cardiovascular reactivity during stress (i.e., buffering hypothesis of support; Smith et al., 2009; Thorsteinsson & James, 1999). These data are important because increased cardiovascular reactivity to stressors has been linked to cardiovascular disease risk (Chida & Steptoe, 2010; Krantz & Manuck, 1984).

Although there are generally both psychological and physiological benefits from receiving and perceiving support from others (Lepore, 1998; Uchino, Cacioppo, &

Kiecolt-Glaser, 1996; Uchino & Garvey, 1997), these beneficial findings appear to be moderated by important contextual factors. For instance, Thorsteinsson and James (1999) found that the links between social support and lower cardiovascular reactivity during stress were moderated by expression of support (i.e., verbal vs. silent support), the support provider (e.g., friend vs. confederate vs. alone), and task type (e.g., speech vs. math task). For example, verbal support produced larger effect sizes than silent support for heart rate, systolic blood pressure, and diastolic blood pressure (Thorsteinsson & James, 1999). In addition, we recently argued that benefits to receiving support depend on moderating contextual factors, such as recipient-related variables (e.g., choice in receiving support) and task-related variables (e.g., matching hypothesis: type of support provided and its match to the needs associated with a specific stressor; Uchino, Carlisle, Birmingham, & Vaughn, 2011).

We have also argued that another important moderator of links between social support and health is the quality of the relationship (Uchino, Holt-Lunstad, Uno, & Flinders, 2001). As we all may know, not all relationships are uniformly positive (Braiker & Kelly, 1979), so it may be expected that social support provided by network ties with whom we associate varying degrees of positivity and negativity may not always be experienced as completely beneficial, with implications for stress appraisals and cardiovascular reactivity (CVR). This is important because a small but growing literature is consistent with the health risks associated with negative social ties (De Vogli, Chandola, & Marmot, 2007; Friedman et al., 1995). In fact, it has been argued that positive and negative aspects of relationships are separable dimensions altogether, and hence, may be uncoupled (i.e., only positive or only negative aspects) or may even

cooccur (i.e., both positive and negative aspects; Uchino et al., 2001). Work on the quality of relationships people perceive with support providers has shown that when directly interacting with individuals whom support recipients feel both positively and negatively towards (i.e., ambivalent ties), recipients experience increased CVR during laboratory stress as well as when support seeking (Holt-Lunstad, Uchino, Smith, & Hicks, 2007; Uno, Uchino, & Smith, 2002). Support from ambivalent ties is also associated with higher ambulatory blood pressure during daily life compared to interactions with other relationship ties, such as people we feel only positively or only negativity towards (Holt-Lunstad, Uchino, Smith, Cerny, & Nealey-Moore, 2003).

Now imagine a circumstance where some of this felt negativity is stored in memory where it can influence perceptions of, and response to, support if activated, yet may not be available for recall unless brought into conscious awareness. Consistent with work on mental models of cognition, studies showing social support as not always being beneficial may in part be due to relationship representations in memory containing information about specific social ties that people are unable to consciously reflect on when deliberately thinking about and reporting on the relationship quality of these network members (cf. Greenwald & Banaji, 1995). Thus, the main goal of this study is to examine the relative predictive utility of both explicit and implicit measures of relationship quality on cardiovascular reactions during "supportive" social interactions.

Implicit Social Cognition and Unobtrusive Measures

What people can easily describe about their social relationships on self-report measures (e.g., *I consider my best friend a source of support*), may be different from what they actually have access to at a less conscious, more automatic level (e.g., *My best*

friend has often criticized the way I deal with events in my life; cf. Bargh & Chartrand, 1999; Greenwald & Banaji, 1995; Lee, Rogge, & Reis, 2010; Scinta & Gable, 2010). Thus, if given a self-report questionnaire and asked to rate this friend's supportive nature, it is possible the individual will only be able to recall the positive aspects of a caring friend if that is the information currently available for deliberate recall (for a discussion on accessibility of attitudes, see Fazio, Sanbonmatsu, Powell, & Kardes, 1986). What could possibly be missing in this self-report is information from past experiences with this friend that is either not retrievable or, if accessible, purposefully not reported on (e.g., self-presentational concerns; Gaertner & Dovidio, 1986; Fazio, Jackson, Dunton, & Williams, 1995). Consistent with a self-presentational concern, it is possible that people may underreport felt negativity. Murray and Holmes' (1999) work on close relationships has shown that people who are satisfied with their relationship minimize and find redeeming features in their partners' faults—integrating them with greater virtues into more general mental models. In any case, it is possible that this withheld or consciously inaccessible information can still be activated in memory, influencing perception and response, regardless of whether the person would consciously endorse this information (Devine, 1989; Greenwald & Banaji, 1995).

Greenwald and Banaji's (1995) landmark review on implicit social cognition suggests that past experiences influence judgment in a way that can be introspectively unknown to the actor. So not only does what we *can* consciously recall influence judgments and behavior, but what we *cannot* consciously recall, as well. This idea is consistent with the dual attitudes model, which suggests the coexistence of two attitude systems (i.e., explicit and implicit; Wilson, Lindsey, & Schooler, 2000). Explicit

attitudes reflect evaluations produced by controlled processes, while implicit attitudes reflect evaluations activated automatically and possibly without intention or awareness (Greenwald & Banaji, 1995; Wilson et al., 2000).

With the advent of implicit, or unobtrusive, methodological techniques it became possible to measure a wide range of constructs thought to be operating at a more automatic level. Many of these techniques rely on response latencies, which measure associations between attitude objects and related evaluations, where the activation of an attitude object facilitates the activation of linked evaluations and/or information about that object. It is assumed that more closely related concepts (e.g., "pie" and evaluations of "good") are activated more quickly and strongly than concepts sharing more weak links ("war" and evaluations of "good"; cf. Fazio & Towles-Schwen, 1999; Neely, 1977). Because people would not be able to control this mental process of automatic activation, many unobtrusive response latency measures may provide a less consciously biased estimate of the attitude object (Scinta & Gable, 2010).

Social Relationships and Unobtrusive Measures

Over the past decade, a handful of relationship researchers have begun utilizing unobtrusive measures to shed light on more implicit attitudes, or what people might be unaware of or unwilling to report about their close relationships. This work includes topics such as marital relations (Fincham & Rogge, 2010), attachment (Zayas & Shoda, 2005), relationship well-being (Banse & Kowalick, 2007), and relationship decay (Lee et al., 2010). For example, Lee et al. (2010) assessed implicit positive and negative attitudes towards a romantic partner and found that positive implicit attitudes were associated with a reduced risk of breakup over the following 12 months above and

beyond the predictions of self-report measures of relationship satisfaction. This study suggests that early signs of relationship decay may be found within attitudes that people are unable or unwilling to report. What has not yet been investigated is how implicit and explicit views of relationships could influence physiological response during a support interaction, potentially having implications for long-term health outcomes.

Most of our prior work has used a more explicit measure of relational attitudes to categorize people's social network ties into four support types (cf. Uchino et al., 2001). The most influential of these relational types on health outcomes has been supportive ties (i.e., people associated with high levels of relationship-specific positivity and low levels of negativity) and ambivalent ties (i.e., people associated with high levels of both relationship-specific positivity and negativity). Ambivalent ties, as mentioned above, are linked to detrimental health outcomes. For example, ambivalent ties have been linked with poorer psychological (Uchino et al., 2001; Uchino, Holt-Lunstad, Smith, & Bloor, 2004), as well as physiological functioning compared to other relationship ties (Holt-Lunstad et al., 2003, 2007; Uno et al., 2002). On the other hand, supportive ties have been linked to better psychological (Uchino et al., 2004) and physiological functioning (Uno et al., 2002).

In terms of implicit relational processes, very few studies have looked at the potential of implicit cognition influencing physiology. Recent work that has examined more automatic relationship processes has shown that simply *thinking* about supportive ties can attenuate CVR during stressful tasks (Ratnasingam & Bishop, 2007; Smith, Ruiz, & Uchino, 2004). In addition, we recently undertook a less obtrusive route to activating relational schemas in memory to examine whether these cognitive representations operate

at a more nonconscious level, similarly to attitudes or stereotypes (i.e., can they be automatically activated and influence individuals outside conscious awareness; Carlisle et al., 2012). Findings demonstrated that automatic activation of ambivalent relationship representations was associated with the highest heart rate reactivity, and greatest respiratory sinus arrhythmia decreases during stress when compared to other relationship types. These studies highlight the importance of examining more automatic/implicit relationship processes in relation to health-relevant outcomes. While implicit and explicit measures are often correlated (e.g., Fazio et al., 1986; Greenwald, McGhee, & Schwartz, 1998; Nosek, 2005), implicit measures also appear to make unique contributions in predicting behavior above and beyond explicit measures (Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Karpinski & Steinman, 2006; Lee et al., 2010; Steinman & Karpinski, 2008), suggesting the utility of both explicit and implicit measures to predict outcomes (Greenwald et al., 2009).

Overview of Study and Hypotheses

For the current study, testing will be divided into two visits, with the Visit One assessing self-report, along with less obtrusive measures, of relationship quality within participants' networks of friends. For Visit Two, participants will be randomly assigned to bring in a friend associated with varying degrees of explicit and implicit support and ambivalence (details below). Two between-participants factors will be included: explicit assessment (supportive, ambivalent) and implicit assessment (supportive, ambivalent). The friend pair will then be asked to discuss a negative event while physiological measures are recorded. Participants will also fill out a series of pretask cognitive appraisals.

Consistent with the buffering model of social support, we predict main effects of relationship assessments such that interacting with a friend rated as either explicitly supportive or implicitly supportive will reduce CVR, as well as increase perceptions of control, and decrease perceptions of threat and stress associated with the speaking task. However, when interacting with a friend rated as either explicitly ambivalent or implicitly ambivalent, we would expect a pattern similar to what we have traditionally seen with explicitly-rated ambivalent ties, such that participants will experience increased CVR, lower perceptions of control, and higher perceptions of threat and stress associated with the speaking task.

More importantly, we may find differences in main effects of assessment types, depending on the outcome variable. We have two competing hypotheses specific to the predictive power of explicit vs. implicit measures of relational attitudes on CVR. More specifically, dual-process models of social cognition suggest that explicit attitudes will guide deliberate responses, but play a weaker role in determining automatic responses (Asendorpf, Banse, & Mücke, 2002; Devine, 1989; Dovidio, Kawakami, Johnson, Johnson & Howard, 1997; Egloff & Schmukle, 2002; Fazio, 1990; Wilson et al., 2000). Additionally, Wilson et al. (2000) suggest that implicit attitudes influence automatic responses. In accordance with dual-process models, we would predict for the current study that the implicit measure of relational attitude would guide, or be more predictive of, CVR (i.e., automatic response) than the explicit measure of relational attitude. On the other hand, some automaticity theorists highlight that implicit measures are sometimes highly correlated with parallel explicit measures of attitude (e.g., Greenwald, Nosek, & Banaji, 2003; Nosek, 2005). For example, Aron, Aron, Tudor, and Nelson (1991) used a

computerized trait-sorting task to demonstrate that higher levels of implicit closeness with a romantic partner were significantly correlated with higher levels of self-reported closeness (also see, Banse & Kowalick, 2007 for correlated implicit/explicit partner attitudes). For the current study, under this latter circumstance we would expect to find no difference in predictive ability between the implicit or explicit relational assessment for CVR.

METHOD

Participants

Eighty healthy women and 34 healthy men (n = 114) were recruited from either the psychology participant pool or drawn from the community. We recruited individuals 18-35 years old only, as we wanted to limit the possibility participants were taking any cardiovascular medications and because we were interested in cardiovascular effects independent of aging. Inclusion criteria were as follows: (a) between 18-35 years of age (b) no cardiovascular prescription medication use (c) no preexisting hypertension or history of chronic disease with a cardiovascular component (e.g., diabetes, kidney or heart disease), and (d) no recent history of psychological disorder(s), including those for which participants were currently being medicated (e.g., major depressive disorder, bipolar disorder). Two participants were dropped from all analyses because they were above age 35, 8 were dropped for not completing second visits, and 4 were dropped for bringing immediate family members to the second visit. Participants completing both visits (n = 100) were mostly White (63%), single/never wed (85%), and had completed partial college (74%; see Table 1). All participants had normal, or corrected-to-normal, vision. Participants were randomized to a 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) between participant design.

Table 1

Demographics for Participants Who Completed Both Study Visits

Variable	n=100	Percentage
Sex		
Female	70	70%
Male	30	30%
Ethnicity		
White	63	63%
Hispanic/Latino	16	16%
Asian	16	16%
Black	3	3%
Native American	1	1%
No response	1	1%
Marital Status		
Married	12	12%
Single/never wed	85	85%
Divorced	2	2%
No response	1	1%
Education		
Graduated from high school	11	11%
Partial college	74	74%
Graduated from college	10	10%
Partial graduate/professional school	4	4%
Graduated from graduate/ professional school	1	1%

Procedures

In Visit One, participants filled out informed consent, the social relationships index (SRI) listing six friends, various questionnaires, and performed six partner-focused Go/No-Go Association Tasks (Partner-GNATs; see Lee et al., 2010). Following the SRI, as participants were filling out various questionnaires, the experimenter inserted the first names, last names, and nicknames of the six friends from the SRI into its own Partner-GNAT (i.e., each name had its own GNAT, for a total of 6), which the participant

completed as the final tasks of the first visit. The SRI provided more deliberate explicit measures of relational attitudes, while the Partner-GNATs provided less obtrusive implicit attitudinal measures of the same friendships. We then asked participants to contact and bring in a specific friend from their list of rated SRI relationships. This friend was selected by the experimenter based on each participant's random assignment to relationship condition (i.e., explicit support/implicit support, explicit support/implicit ambivalence, explicit ambivalence/implicit ambivalence, explicit ambivalence/implicit support). If more than one friend fit the criteria for the randomly assigned category, the friend who was the better fit of the category was chosen (e.g., the friend who "most" fit the criteria for being explicitly supportive/implicitly supportive).

Within 3 to 14 days of Visit One, participants came back with their preselected, randomly assigned friends for Visit Two. They were told that we were interested in how talking influences physiology, and that the reason this particular friend had been invited to accompany them is because according to results in Visit One's questionnaires, this friend seemed like somebody that could keep the participant talking. They were informed that part of the friend's responsibility during the experiment would be to keep the participant talking by "saying what would come natural to you in the situation" (Holt-Lunstad et al., 2007; Reblin, Uchino, & Smith, 2010). Participants were then separated from their friends, who completed a consent form and a demographic questionnaire while the participant was fitted with an occluding blood pressure cuff and disposable spot electrodes placed according to published guidelines for thoracic impedance collection (Sherwood et al., 1990). Participants then completed a negative event questionnaire (see measures), which doubled as an adaptation period. Following the approximately 10

minute adaptation period, the friend was escorted into the room and seated across from the participant. The participant and friend were instructed to relax for the next 12 minutes while resting measures of cardiovascular function were obtained (note: physiological recordings were only collected from the participant). Both were asked not to talk during the rest period and a divider was placed between them. After the first baseline, and as an acclimation to discussion in the lab, the participant and friend were instructed to discuss what they do during a normal weekday for 4 total minutes, including activities they do with each other, alternating speaking and listening for 1-minute epochs to hold constant speech effects on CVR (e.g., Friedman, 1982; Reblin et al., 2010). This neutral discussion was then followed by a second baseline, with procedures identical to the first baseline, with the exception that it was 7 minutes in length.

The participant and friend were then asked to discuss one of the participant's listed negative life events preselected by the experimenter from the event questionnaire. Event selection was based on an event rated as moderately high on negativity, such that all participants' discussions, regardless of condition, were relatively equivalent on that aspect to control for event intensity. The event was discussed for a total of 6 minutes and included the participant talking about three aspects of the event: first, describing the details of the event, second, talking about his/her thoughts and feelings regarding the event, and lastly, discussing how he/she handled the event and/or how they might have changed anything. After each discussion aspect, the friend was given 1 minute to respond. Thus, again, they were alternating speaking and listening for 1-minute epochs to hold constant speech effects on CVR. Following the negative event discussion, both

friends filled out study surveys. Finally, participants and their friends were thanked, debriefed, and compensated for their time.

Cardiovascular assessments were taken throughout the baselines and tasks. Heart rate (HR), impedance-derived measures, and respiratory sinus arrhythmia (RSA) was obtained continuously, while systolic blood pressure (SBP) and diastolic blood pressure (DBP) was obtained once every 90 sec during baseline and at the beginning of each minute during the discussion tasks. Self-reports of perceived control, stress, and coping with the discussion tasks were assessed before the negative event discussion. See Table 2 for an overview of procedures and main dependent variables.

Table 2

Physiological and Psychological Dependent Measures Taken During Each Experimental Epoch

Experimental Epoch	Length of Epoch	Measurement(s)
Visit One		Consent, background and health questionnaires, SRI, GNATs
Visit Two		
Prebaseline 1		Event rating list
Baseline 1	12 min	SBP, DBP, HR, RSA, PEP, TPR, CO
Neutral Discussion	4 min	SBP, DBP, HR, RSA, PEP, TPR, CO
Baseline 2	7 min	SBP, DBP, HR, RSA, PEP, TPR, CO
PreNeg Discussion		State Anxiety, SSES, Perceived Stress, Coping & Control
Negative Discussion	6 min	SBP, DBP, HR, RSA, PEP, TPR, CO
Postdiscussion		State Anxiety, SSES, IMI, PDR, POS
Recovery	6 min	SBP, DBP, HR, RSA, PEP, TPR, CO

Note. SRI = social relationships index; GNATs = Go/No-Go Association Tasks; SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; RSA = respiratory sinus arrhythmia; PEP = preejection period; TPR = total peripheral resistance; CO = cardiac output; SSES = state self-esteem scale; IMI = impact message inventory; PDR = postdiscussion rating; POS = perception of support.

Assessments

Cardiovascular Measures

A Dinamap Model 100 was used to measure SBP and DBP. The Dinamap uses the occillometric method to calculate blood pressure. Blood pressure assessments were obtained using a properly sized occluding cuff positioned on the upper left arm of the participant according to manufacturer's specifications. Mean SBP and DBP for each epoch (i.e., baselines and speech tasks) was averaged across minutes to increase the reliability of these assessments (Kamarck, 1992).

A Mindware 2000D Impedance Module was used to measure cardiac output (CO), preejection period (PEP), total peripheral resistance (TPR), and respiratory sinus arrhythmia (RSA). Seven spot-electrodes were placed according to manufacturer and published guidelines (Hoetink et al., 2002; Sherwood et al., 1990). The ECG was digitized at 1000 Hz and each waveform was verified or edited prior to analyses. Respiratory sinus arrhythmia (RSA) was calculated based on the digitized interbeat intervals that were checked and edited for artifacts using the detection algorithm of Bernston, Quigley, Jang, and Boysen (1990). Following linear detrending (Bernston, Cacioppo, & Quigley, 1995; Litvack, Oberlander, Carney, & Saul, 1995), the heart-period time series was band-pass-filtered from 0.12 to 0.40 Hz (Neuvo, Cheng-Yu, & Mitra, 1984). The power spectrum of heart-period time series was calculated using a Fast Fourier Transform and scaled to ms^2/Hz. All measures were calculated as the natural log of the area under the heart-period power spectrum within the corner frequencies of the band-pass filter (Litvack et al., 1995). RSA was calculated on a minute-by-minute basis and aggregated across minutes within each epoch to increase measurement reliability.

Psychological Measures

Social relationships index (SRI). The SRI was developed as a self-report version of the social support interview (Fiore, Becker, & Coppel, 1983; Kiecolt-Glaser, Dura, Speicher, Trask, & Glaser, 1991; Uchino, Kiecolt-Glaser, & Cacioppo, 1992). This form of the SRI instructs individuals to list six nonromantic and nonfamilial same-sex friends whom they would be willing to bring to the second visit with them. These friends were rated in terms of how generally helpful and upsetting they are on a 1 (not at all) to 6 (extremely) point scale. The SRI allows an operationalization of different categories of social relationships as primary sources of positivity (i.e., supportive), primary sources of negativity (i.e., aversive), sources of both positivity and negativity (i.e., ambivalent), or low levels of positivity and negativity (i.e., indifferent). For the purposes of this study, only the supportive and ambivalent categories were used. A supportive tie was operationalized as a friend rated as a 2 or greater on positivity and only a 1 on negativity, whereas an ambivalent tie would be a friend rated as a 2 or greater on both positivity and negativity (see Uchino et al., 2001). Prior work has shown that these network measures are temporally stable with significant 2-week test-retest correlations (see Campo et al., 2009). This measure provided us with the first name, last name, and nickname of each friend used as stimuli in the Go/No-Go Association Tasks.

Partner Go/No-Go Association Task (Partner-GNAT). A Partner-GNAT program using Inquisit (2011) computer software was used to measure relational attitudes, modified based on Lee et al. (2010) Study 2 procedures. This is a word-sorting task, where stimuli are presented one at a time in random order, and participants are instructed to sort them into categories (i.e., *helpful* words, *upsetting* words, and *friend* words). For

each block of trials, specific categories of stimuli are assigned as targets, requiring a "go" response (pressing the spacebar), while the other words are distracters, requiring a "no-go" response (not hitting the spacebar). Stimuli were presented for 600 ms each, with an intertrial interval of 400 ms. After each trial, a green *O* is flashed on the screen for correct responses, or a red *X* for incorrect responses (400 ms). Relationship-specific *helpful* (e.g., *understanding, sharing, accepting)* and *upsetting* (e.g., *attacking, nagging, criticizing*) words were used for the positive and negative stimuli. For *friend* words, information collected from the SRI was utilized as stimuli (i.e., first name, last name, and nickname).

The Partner-GNAT consists of four blocks, comprising 172 total trials. Participants began with two practice blocks of 16 trials each, sorting good (i.e., *helpful*) words from bad (i.e., *upsetting*). Next, participants performed two complex 70-trial blocks, discriminating among three sets of stimuli (*helpful, upsetting,* and *friend* words). In one 70-trial block, *helpful* and *friend* words were paired as targets requiring a "go" response (friend-good trials), and in the other, *upsetting* and *friend* words were paired as targets requiring a "go" response (friend-bad trials). The order of the complex blocks was counterbalanced across GNATs and participants. As mentioned in the procedures, each of the six friends listed on the SRI were used as stimuli on six different GNATs (i.e., each GNAT only contained the information for one of the six friends).

Because we wanted to calculate GNAT scores and assign relationship categories similarly to the way we calculate and classify individuals on the SRI (i.e., having a range of low to high positivity score and a range of low to high negativity score), we utilized total errors on partner-good and partner-bad blocks. More specifically, we were able to

assign each friend a range of low to high positivity by using the total number of errors made on the partner-good trials, and a range of low to high negativity by using the total number or errors on the partner-bad trials. Lower errors on a given trial would indicate congruence with the attitude and that trial's word "theme" (e.g., relatively low errors on partner-good trials would indicate the attitude towards that friend is congruent with the more positive words displayed in that trial; Nosek, 2001). To determine whether a given error total was low vs. high, we took into account all errors for a given participant in all his/her six friend's trials, then categorized the implicit friendship attitude as outlined in Table 3.

Life event sheet. Participants were asked to list up to five past negative experiences that they would feel comfortable discussing with their friend as part of the experiment (see Holt-Lunstad et al., 2007). Participants rated each event on a scale of 1 (not at all) to 5 (extremely) on the degree of importance, positivity, and negativity, of each event in comparison to all possible negative events in their life. The event rated the highest in negativity was used as the topic for the negative event discussion task.

Perceived stress and coping. Before the negative event discussion, participants completed a measure of challenge and threat appraisals utilized by Tomaka, Blascovich, Kibler, and Ernst (1997). Participants were asked to rate on a 6-point Likert scale "how stressful do you expect the discussion task to be" and "how able are you to cope with the discussion task".

Perceived control. Before the negative event discussion, perception of perceived control was assessed via items used in prior social psychophysiological studies (Gerin,

Table 3

Details for Categorizing Implicit Relationship Categories Using Error Rate on the GNAT

Relationship Category	Partner Block	Error Rate	Congruence
Implicit Ambivalent	Friend-Good	High	IC
	Friend-Bad	High	IC
~The friend attitude is not congruent with either good or bad words; thus, there is an ambivalent implicit attitude.			
Implicit Support	Friend-Good	Low	C
	Friend-Bad	High	IC
~The friend attitude is congruent with good words, but incongruent with bad words; thus, there is a supportive implicit attitude.			
Implicit Ambivalent			
	Friend-Good	Low	C
	Friend-Bad	Low	C
~The friend attitude is congruent with both good and bad words; thus, there is an ambivalent implicit attitude.			
Implicit Ambivalent	Friend-Good	High	IC
	Friend-Bad	Low	C
~The friend attitude is incongruent with good words and congruent with bad words; thus, there is an ambivalent implicit attitude.			

Note. C = Congruent Partner Block with Friendship Attitude; IC = Incongruent Partner Block with Friendship Attitude.

Litt, Deich, & Pickering, 1995). Participants were asked, "How much control do you feel you have over this task" on a 10-point Likert scale.

State anxiety scale. The short-form of the Spielberger State-Trait Anxiety Scale was administered to participants before and after the negative event discussion (Marteau & Bekker, 1992). Participants were asked to rate their current feelings on a 1 (not at all) to 4 (very much) point scale. The internal consistency of the scale in prior work has been high ($\alpha > .78$).

Postdiscussion rating (PDR). To examine the psychosocial processes associated with the negative event discussion, a short questionnaire (PDR) was utilized based on our prior work (see Holt-Lunstad et al., 2007; Reblin et al., 2010). Participants were asked to rate on a 1 (not at all) to 7 (extremely) point scale, items tapping into their perceptions of the interaction (e.g., *how helpful was your friend during the discussion*) and if they had discussed the problem with the friend in the past (see Table 4).

Perception of support (POS). A nine-item questionnaire based on our prior work (see Uno et al., 2002) was used to assess the participant's perception of social support during the negative event discussion. The items on this scale can be divided into two scales: emotional support and instrumental support. Examples of items for both scales are, "*My friend made me feel good about myself during the problem discussion,*" and "*My friend gave me suggestions on how to deal with the problem"* respectively. Both the emotional and instrumental support subscales have been shown to have good internal consistency (cf. Uno et al., 2002). Participants were also asked to make a forced-choice selection in response to the following single-item statement: "*During the negative event*

Table 4

Postdiscussion Rating Scale

Scale Items
1. How *open* were you to disclosing this even with your friend?
2. How *comfortable* did you feel discussing this even with your friend?
3. How *helpful* was your friend during the discussion?
4. How *challenging* was the even discussion task?
5. How *upsetting* was your friend during the discussion?
6. How *mixed and conflicted* were your thoughts and feelings toward your friend during the discussion?
7. How *effortful* was it to do the discussion task?
8. How *threatening* was the event discussion task?
9. How *difficult* did you find the discussion task?
10. How *natural* was the discussion compared to normal discussions with this friend?
11. To what extent did your friend respond as *normally* as he or she would outside this experiment?
12. How *familiar* was your friend with the event that you discussed?
13. When discussing this event with this person in the past, how *helpful* has your friend been?
14. When discussing this event with this person in the past, how *upsetting* has your friend been?
15. To what extent have you discussed this event with *this friend* before?
16. To what extent have you discussed this event with *anyone* before?

Note. Participants will be asked to rate their current feelings on a 6-point scale from 1 (not at all) to 6 (extremely). For Items 15 and 16, the scale will be from 1 (never) to 6 (at great lengths).

discussion, I think my friend was trying to: give me problem-focused help, make me feel better, or did neither".

Impact Message Inventory (IMI). The IMI (Kiesler et al., 1985) is a circumplex-based inventory designed to assess perceptions of another's interpersonal behavior along the dimensions of friendliness vs. hostility, and dominance vs. submissiveness. It contains 32 items with 4 items per octant. Kiesler, Schmidt, and Wagner (1997) provided evidence supporting the circumplex structure of the IMI and demonstrated its adequate psychometric properties. It has been found to be sensitive to similar

interpersonal manipulations in prior research (Nealy, Smith, & Uchino, 2002). The IMI was completed following the negative event discussion.

State Self-esteem Scale (SSES). The SSES (Heatherton & Polivy, 1991) was administered to participants before and after the negative event discussion task. The SSES consists of 20 items modified from the widely used Janis-Field Feelings of Inadequacy Scale and is sensitive to both naturally occurring and laboratory-based threats. This scale has good psychometric properties (e.g., $\alpha = .92$).

Statistical approach. A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAs were conducted, with these variables as between participant factors on all psychological dependent measures. For physiological assessments, all measurements were first reduced and averaged into 1-minute segments, followed by an average value obtained for each epoch to increase the reliability of these assessments (Kamarck, 1992). Change scores were then computed as an index of reactivity (average discussion task epoch – average baseline epoch), with baseline values statistically controlled for in the analyses (Llabre, Spitzer, Saab, Ironson, & Schneiderman, 1991). We then ran 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANCOVAs with these variables as between participant factors on the main cardiovascular measures of heart rate and blood pressure. Secondary analyses were focused on the determinants of heart rate and blood pressure as revealed by impedance cardiography (i.e., PEP, RSA, CO, TPR; Sherwood et al., 1990).

RESULTS

Manipulation Checks and Preliminary Analyses

Study Group Randomization

To verify our relationship category manipulation, we ran separate tests for explicit and implicit categories of the friends brought to Visit 2. We conducted four 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAs with continuous variables of explicit and implicit positivity and negativity centered as dependent variables. Consistent with our classification, analyses revealed no significant differences in levels of explicit positivity in supportive or ambivalent ties ($LSM_{Exp\ Supportive}$ = 0.04 vs. $LSM_{Exp\ Ambivalent}$ = -0.02). There was also an expected main effect of negativity on our explicit assessment, $F(1, 96) = 125.81$, $\eta^2 = .54$, $p < .001$, with higher levels seen in ambivalent ties than supportive ($LSM_{Exp\ Ambivalent}$ = 0.69 vs. $LSM_{Exp\ Supportive}$ = -0.72). We then found a main effect of positivity on our implicit assessment, $F(1, 96) = 4.48$, $\eta^2 = .04$, $p < .05$, with fewer errors on partner-good trials in supportive groups than ambivalent groups ($LSM_{Exp\ Supportive}$ = -1.32 vs. $LSM_{Exp\ Ambivalent}$ = 1.14). Finally, we found the anticipated main effect for implicit negativity, $F(1, 96) = 13.79$, $\eta^2 = .13$, $p < .001$, such that fewer errors were made on the partner-bad trials in ambivalent groups than supportive groups ($LSM_{Exp\ Ambivalent}$ = -2.28 vs. $LSM_{Exp\ Supportive}$ = 2.88).

Preliminary Analyses

A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAS revealed there were no significant differences in how helpful or challenging participants felt their friends were during the negative event discussion, nor in whether they reported friends responded normally during this discussion or whether the interaction felt natural compared to other everyday discussions with their friends. There were also no reported differences in how effortful or difficult the negative event discussion was. Thus, regardless of relationship categorization or the assessment used (explicit or implicit), participants were rating the experience of the negative event discussion quite similarly across groups.

To help better understand the friendships in this study, we looked at participant self-reported characteristics of the relationship. A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAS revealed there were no significant differences in length of time participants had known the friends, the amount of weekly contact, or the importance of these friends. A main effect of our explicit assessment on how unpredictable their friends generally are, $F(1, 95) = 11.09$, $\eta^2 = .10$, $p < .01$, showed that explicitly ambivalent friends are considered more generally unpredictable than explicitly supportive friends ($LSM_{Exp\ Ambivalent} = 2.76$ vs. $LSM_{Exp\ Supportive} = 2.0$). Unexpectedly, explicitly ambivalent ties were rated higher in terms of how much participants disclose private things to them, $F(1, 94) = 4.42$, $\eta^2 = .04$, $p < .05$, ($LSM_{Exp\ Ambivalent} = 3.44$ vs. $LSM_{Exp\ Supportive} = 3.1$), as well as sharing memories, $F(1, 96) = 7.5$, $\eta^2 = .07$, $p < .01$, ($LSM_{Exp\ Ambivalent} = 3.62$ vs. $LSM_{Exp\ Supportive} = 3.19$). While friendship investment and linking a sense of personal identity to the friend were

not significantly predicted by relationship assessment on their own, an average relationship variable was computed using investment, disclosure, identity, and shared memories, and this variable revealed main effects of our explicit assessment, $F(1, 96) = 6.79$, $\eta^2 = .06$, $p < .05$, such that explicitly ambivalent relationships were characterized by greater friendship investment than explicitly supportive friends ($LSM_{Exp\ Ambivalent} = 3.31$ vs. $LSM_{Exp\ Supportive} = 2.98$).

Explicit and Implicit Assessment Effects on Psychological Outcomes

Main Psychological Analyses

Appraisals of the negative event discussion. A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAS revealed no significant differences between how stressful any of the relationship groups perceived the negative event discussion would be; however, some marginal effects for prediscussion appraisals were observed. There was a marginal main effect of the implicit assessment on perceptions of control over the upcoming negative event discussion, $F(1, 95) = 3.21$, $\eta^2 = .03$, $p = .07$, with the implicitly supportive group rating less control than the implicitly ambivalent group ($LSM_{Exp\ Supportive} = 3.98$ vs. $LSM_{Exp\ Ambivalent} = 4.26$). A marginal interaction effect was found for how well participants felt they could cope with the negative event discussion, $F(1, 95) = 2.96$, $\eta^2 = .03$, $p = .08$, such that participants about to interact with an explicitly supportive/implicitly supportive friend had the lowest perceived coping ability ($LSM = 3.92$), followed by explicitly ambivalent/implicitly ambivalent ($LSM = 4.11$), explicitly ambivalent/implicitly supportive ($LSM = 4.19$), and explicitly supportive/implicitly ambivalent ($LSM = 4.44$). Follow-up comparisons

revealed that perceptions of ability to cope were significantly lower in the explicitly supportive/implicitly supportive group than the explicitly supportive/implicitly ambivalent group ($p < .05$). No other comparisons were significant ($ps > .15$). In addition, postdiscussion appraisals showed no significant differences for how threatening the negative event discussion was.

Secondary Psychological Analyses

State anxiety and state self-esteem. Change scores were computed for our measures of state anxiety and state self-esteem (postdiscussion minus prediscussion ratings). Controlling for prediscussion ratings, a series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANCOVAs revealed an interaction between our explicit and implicit assessments on state self-esteem, $F(1, 95) = 5.55$, $\eta^2 = .02$, $p < .05$, where the least change in self-esteem from pre- to postdiscussion was seen in participants with friends categorized as explicitly supportive/implicitly supportive (*LSM* = 1.29), followed by explicitly ambivalent/implicitly ambivalent friends (*LSM* = 1.43), explicitly ambivalent/implicitly supportive friends (*LSM* = 1.63), and explicitly supportive/implicitly ambivalent (*LSM* = 1.78). Follow-up comparisons revealed that self-esteem change in the explicitly supportive/implicitly ambivalent group was greater than in the explicitly supportive/implicitly supportive group ($p < .05$). No other comparisons were significant ($ps > .09$). No effects were found for changes in anxiety.

Social emotions and impact message inventory (IMI). A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAs revealed a main effect of explicit relationship assessment for self-conscious

feelings during the negative event discussion, $F(1, 96) = 4.72$, $\eta^2 = .05$, $p < .05$, with lower feelings of self-consciousness reported in explicitly supportive relationships compared to explicitly ambivalent ($LSM_{Exp\ Supportive} = 1.91$ vs. $LSM_{Exp\ Ambivalent} = 2.4$). No other effects were found for social emotions. The IMI revealed a significant main effect of explicit assessment on dominance, $F(1, 96) = 5.46$, $\eta^2 = .05$, $p < .05$, where friends rated as explicitly supportive were perceived as less dominant just after the negative event discussion than ambivalent friends ($LSM_{Exp\ Supportive} = -1.35$ vs. $LSM_{Exp\ Ambivalent} = -0.92$). No effects were found for perceptions of friendliness on the IMI.

Postdiscussion 2 scale and perceptions of support. A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANOVAs revealed significant main effects of our explicit assessment and the interaction term of explicit x implicit assessment on several relationship processes during the negative event discussion; however, no implicit main effects were found. A main effect for the explicit assessment was found on how upsetting the friend had been *in the past* when discussing the same event, $F(1, 94) = 7.42$, $\eta^2 = .07$, $p < .01$, where explicitly ambivalent friends were rated as more upsetting in the past than explicitly supportive friends ($LSM_{Exp\ Ambivalent} = 1.95$ vs. $LSM_{Exp\ Supportive} = 1.36$). A marginal effect of explicit assessment on how upsetting the friend was *during* the event discussion shows explicitly ambivalent friends as more upsetting ($LSM = 1.76$) than explicitly supportive friends ($LSM = 1.38$), $F(1, 96) = 3.31$, $\eta^2 = .03$, $p = .07$. Finally, a significant interaction was found for how mixed and conflicted the participants' thoughts and feelings towards their friends were during the event discussion, $F(1, 96) = 6.84$, $\eta^2 = .06$, $p < .05$, such that interacting with a friend categorized as explicitly ambivalent/implicitly ambivalent was

associated with the highest mixed and conflicted thoughts and feelings (*LSM* = 2.61), followed by explicitly ambivalent/implicitly supportive (*LSM* = 1.71), explicitly supportive/implicitly supportive (*LSM* = 1.67), and explicitly supportive/implicitly ambivalent (*LSM* = 1.33). Follow-up comparisons revealed ratings of mixed and conflicted feelings were significantly lower in the explicitly ambivalent/implicitly supportive group ($p < .05$) and the explicitly supportive/implicitly ambivalent group ($p < .01$) compared to the explicitly ambivalent/implicitly ambivalent group. No other comparisons were significant (ps > .09).

The perceptions of support scale revealed a main effect of explicit assessment on how critical friends were perceived to be during the event discussion, $F(1, 95) = 4.23$, $\eta^2 = .04$, $p < .05$, with explicitly ambivalent friends rated as more critical than explicitly supportive ($LSM_{Exp\ Ambivalent} = 1.79$ vs. $LSM_{Exp\ Supportive} = 1.39$). No other effects were found for this scale, including for the subscales of emotional and tangible support.

Explicit and Implicit Assessment Effects on Cardiovascular Reactivity

Main Cardiovascular Analyses

Our main cardiovascular analyses were based on reactivity scores (discussion task minus baseline) while also statistically controlling for baseline levels. A series of 2 (Explicit Assessment: Supportive, Ambivalent) x 2 (Implicit Assessment: Supportive, Ambivalent) ANCOVAs revealed a main effect for the implicit assessment on HR reactivity, $F(1, 95) = 4.89$, $\eta^2 = .04$, $p < .05$. This effect demonstrated that participants who interacted with a friend rated as implicitly supportive had greater HR reactivity during the negative event discussion task than participants who interacted with friends

rated as implicitly ambivalent ($LSM_{Imp\ Supportive}$ = 5.88 vs. $LSM_{Imp\ Ambivalent}$ = 3.67). No other effects were found on any of the other cardiovascular assessments (*p*s > .07, see Table 5 of *M,SD*).

Exploratory Internal Analyses

To test whether positivity or negativity treated as continuous variables across assessments significantly predicted our cardiovascular measures during the negative

Table 5

Least Squares Means and Standard Errors (M, SE) for Cardiovascular Dependent Variables

	Study Group			
Variable	Exp Supp/ Imp Supp	Exp Supp/ Imp Amb	Exp Amb/ Exp Amb	Exp Amb/ Imp Supp
Resting (Baseline 2)				
SBP (mmHg)	108.11 (2.11)	108.2 (1.99)	109.63 (1.96)	108.79 (2.26)
DBP (mmHg)	66.67 (1.68)	63.52 (1.59)	65.64 (1.56)	64.29 (1.8)
CO (1/min)	4.8 (0.33)	4.26 (0.3)	4.5 (0.29)	4.64 (0.35)
TPR (Dynes-s • cm^{-5})	1546 (95.53)	1575 (85.86)	1553 (84.25)	1446 (100.43)
HR (BMP)	73.54 (2.3)	70.51 (2.17)	72.6 (2.13)	75.6 (2.46)
PEP (ms)	123.64 (2.54)	126.23 (2.39)	117.83 (2.31)	118.43 (2.73)
RSA (log)	6.48 (0.26)	6.71 (0.24)	6.07 (0.24)	6.56 (0.28)
Reactivity (Negative Event Discussion				
SBP (mmHg)	7.09 (1.41)	7.18 (1.33)	6.52 (1.31)	7.64 (1.51)
DBP (mmHg)	5.32 (1.18)	4.84 (1.11)	4.87 (1.09)	3.99 (1.25)
CO (1/min)	0.24 (0.20)	0.13 (0.19)	-0.06 (0.18)	-0.23 (0.21)
TPR (Dynes-s • cm^{-5})	49.74 (67.0)	123.4 (61.40)	192.35 (59.11)	211.66 (70.69)
HR (BMP)	6.69 (1.0)	3.51 (0.95)	3.84 (0.93)	5.07 (1.08)
PEP (ms)	-3.32 (1.62)	-0.29 (1.59)	-0.29 (1.49)	-2.56 (1.79)
RSA (log)	0.003 (0.12)	0.13 (0.11)	0.27 (0.11)	0.19 (0.12)

Note. Standard errors are in parentheses. SBP = systolic blood pressure; DBP = diastolic blood pressure; CO = cardiac output; TPR = total peripheral resistance; HR = heart rate; PEP = pre-ejection period; RSA = respiratory sinus arrhythmia.

event discussion, we ran two separate simultaneous multiple regression analyses. First, controlling for baseline levels of cardiovascular reactivity we regressed explicit positivity, negativity, and the cross-product term (positivity X negativity) on each cardiovascular measure. For our explicit assessment, we found a significant main effect for CO change (b= -.21, SE= .01, $p < .05$), such that as explicit negativity increased, CO change decreased. We also found a significant main effect for TPR change (b = 90.62, SE = 32.99, $p < .05$), such that increases in explicit negativity was associated with increased TPR change. This pattern of TPR reactivity is consistent with a physiological threat response (Tomaka et al., 1997). We then found a main effect for RSA change, (b = .12, SE = .06, $p < .05$), such that as explicit negativity increased, so did RSA change. Finally, we found an interaction on PEP change (b = -1.89, SE = .95, $p < .05$). We examined the form of this interaction by plotting predicted values one standard deviation above and below the mean for explicit positivity and negativity (Aiken & West, 1990). As can be seen in Figure 1, the greatest shortening of PEP (indicating greater sympathetic nervous system activity) was found in the explicitly low negativity/low positivity group. In similar analyses using implicit measures as predictors, we found a main effect for CO (b = 0.04, SE = .02, $p < .05$), suggesting as error went up on partner-bad trials (i.e., as participants associated their friends with bad words less), CO increased. We also found a main effect for implicit negativity on RSA change (b= -.03, SE =. 01, $p < .01$), such that as error on partner-bad trials increased (i.e., as participants associated negativity with their friend less), RSA decreased. Finally, we found an interaction for HR change (b = -.02, SE = .01, $p < .01$). As described above, we examined the form of this interaction by plotting predicted values one standard deviation above and below the mean for implicit

positivity and negativity. As can be seen in Figure 2, the greatest HR change was found for the high positivity/low negativity group (supportive), followed by the low positivity/low negativity group. No other implicit effects were found. See Table 6 for a summary regression table.

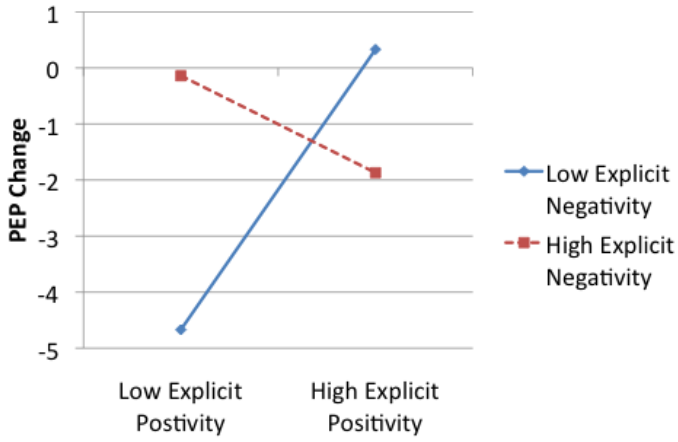

Figure 1. Predicted negative event discussion PEP change one standard deviation above and below the mean for low and high explicit positivity and negativity.

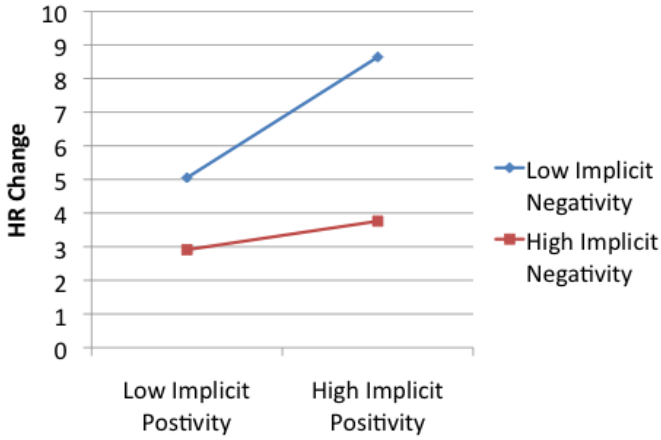

Figure 2. Predicted negative event discussion HR change one standard deviation above and below the mean for low and high implicit positivity and negativity.

Table 6

Multiple Regression Table for Cardiovascular Reactivity During the Negative Event Discussion Predicted by Relationship Assessment as a Continuous Variable

	Explicit			Implicit		
Variable	ß	SE	*p*	ß	SE	*p*
SBP						
Positivity	-0.48	0.76	0.53	0.03	0.14	0.84
Negativity	-0.53	0.73	0.46	0.10	0.11	0.36
Positivity X Negativity	0.39	0.87	0.66	-0.01	0.01	0.67
DBP						
Positivity	-0.03	0.65	0.96	-0.09	0.12	0.43
Negativity	-0.20	0.61	0.74	0.06	0.09	0.53
Positivity X Negativity	0.20	0.72	0.78	0.01	0.01	0.62
CO						
Positivity	0.01	0.10	0.89	0.03	0.02	0.19
Negativity	-0.21	0.10	0.03*	0.04	0.02	0.03*
Positivity X Negativity	-0.00	0.11	0.99	-0.00	0.00	0.08
TPR						
Positivity	-17.49	34.37	0.61	-5.65	6.70	0.40
Negativity	90.62	32.99	0.01*	-8.89	5.51	0.11
Positivity X Negativity	-35.94	38.71	0.36	1.2	0.68	0.08
HR						
Positivity	-0.44	0.56	0.43	-0.20	0.09	0.04*
Negativity	-0.29	0.53	0.58	0.30	0.08	0.0002*
Positivity X Negativity	-0.42	0.63	0.50	-0.02	0.01	0.01*
PEP						
Positivity	0.80	0.85	0.35	0.15	0.17	0.37
Negativity	0.72	0.83	0.39	-0.14	0.14	0.30
Positivity X Negativity	-1.89	0.95	0.04*	0.01	0.02	0.61
RSA						
Positivity	-0.02	0.06	0.71	0.01	0.01	0.18
Negativity	0.12	0.06	0.05*	-0.03	0.01	0.002*
Positivity X Negativity	-0.04	0.07	0.52	0.00	0.00	0.77

Note. * = $p < .05$.

DISCUSSION

The primary aim of this study was to examine explicit and implicit assessment effects on cognitive appraisals and cardiovascular reactivity in relation to a negative event discussion. In terms of appraisals, we found no significant differences for perceptions of stressfulness or threat based on assessment. A marginal interaction effect was found for how well participants felt they could cope with the negative event discussion, with coping perceptions significantly lower in the explicitly supportive/implicitly supportive group than the explicitly supportive/implicitly ambivalent group. There was also a marginal main effect of the implicit assessment on perceptions of control over the upcoming negative event discussion, with the implicitly supportive group rating less control than the implicitly ambivalent group. For reactivity, we found a main effect for the implicit assessment on HR reactivity, such that participants interacting with friends rated as implicitly supportive had greater HR reactivity during the negative event discussion task than participants interacting with friends rated as implicitly ambivalent. No other effects were found on any of the main analyses for cardiovascular reactivity measures.

A secondary aim of this study was to determine whether there was unique predictive power in the implicit assessment for more automatic (cardiovascular) measures. While the direction of our reactivity findings were unexpected, only the implicit assessment significantly predicted cardiovascular reactivity—no significant

explicit assessment effects were found. While it does appear for the current study that the implicit assessment was a better predictor of reactivity, this was only found for HR. Because there was no replication across measures of reactivity (e.g., BP), we suggest more work is needed in order to determine whether implicit assessments are generally more predictive of cardiovascular reactivity than explicit assessments. In addition, these findings do not support the notion that explicit and implicit assessments in this study were necessarily measuring the same construct, as our ancillary analyses showed that explicit positivity and negativity were not significantly related to implicit positivity and negativity.

There were several unexpected findings in the current study. First, the implicit assessment showed implicitly supportive groups associated with higher reactivity than the implicitly ambivalent groups. While there is no comparison in the literature for implicit relationship effects on reactivity, there is a large literature based on stress buffering effects of social support. We did not find any buffering effects of support with either type of assessment, and the implicit assessment predicted *heightened* reactivity, rather than dampened.

At least two possibilities exist for why implicit support was associated with increased HR reactivity: 1) increased stress or 2) increased motivation to do well on the task. Just prior to the negative event discussion, participants about to interact with implicitly supportive friends felt the lowest levels of control over the discussion compared to those about to interact with implicitly ambivalent friends. Exposure to little or no control can be stressful in its own right, and may increase cardiovascular response (DeGood, 1975; Hokanson, 1971). For example, Gerin et al. (1992) found that a low

control group exhibited greater BP and HR reactivity during a word-search task than a high control group. However, for the current study, there were no significant effects of perceived stressfulness of the discussion or of state anxiety, so if participants who interacted with implicitly supportive friends were more stressed or anxious, they for whatever reason were not reporting it.

In terms of motivation, some participants may have been more motivated to perform well on the discussion task if a sense of self is derived from a need for approval from others (Crocker & Wolfe, 2001), and this increased motivation could lead to increased effort and reactivity during the discussion (Obrist et al., 1978; Smith et al., 1989). However, there were no differences found for discussion task effort or difficulty ratings, as may be expected if participants interacting with implicitly supportive friends were more motivated to do well. Overall, none of these explanations fit the data well so future work will be necessary to determine the replicability and/or reasons behind this association.

A second unexpected result is that we did not replicate prior work suggesting that ambivalent relationship ties are associated with the greatest reactivity in both laboratory stressor paradigms (Carlisle et al., 2012; Holt-Lunstad et al., 2007; Uno et al., 2002) and during daily life (Birmingham, Uchino, Smith, Light, & Butner, 2013; Holt-Lunstad et al., 2003). While previous work has only examined explicit forms of ambivalence, we did not find any ambivalence effects of heightened reactivity for either explicit or implicit assessment types. It is unclear why we were unable to replicate effects of explicit ambivalence on reactivity. Prior work has shown ambivalent ties to be seen as less important, less friendly, more dominant, and to elicit higher ratings of task anxiety

compared to supportive ties (Holt-Lunstad et al., 2007; Uchino et al., 2004). The current study only showed a similar pattern for ambivalence and dominance. It appears we may have had a different "type" of ambivalent friend in the current study. In addition, due to the design we only had about 50% of the participants interacting with an explicitly ambivalent tie, so power was necessarily reduced.

It is also possible that we did not replicate our prior results because of the cognitive organization of friend knowledge in this sample. One area of work suggests that organization of knowledge can be evaluatively compartmentalized (keeping the positive relationship attributes separated from the negative attributes) or evaluatively integrative (no separation between positive and negative attributes), with different knowledge structures being associated with separate compartments representing different domains of that person in their life (e.g., best friend, homework buddy, workout partner; cf. Showers & Ziegler-Hill, 2004). It is possible that for explicitly or implicitly ambivalent friendships in the current study, participants compartmentalized the positive and negative attributes of the friendship separately. Thus, in the context of the negative event discussion perhaps only the positive attributes of ambivalent relationships were being activated, leading to attenuation of reactivity in the way normally expected in purely supportive relationships. Because only the positive attributes of ambivalent friendships may have been salient, buffering effects could have been unexpectedly occurring. Similar work shows that, in romantic relationships, individuals often find redeeming features in their partners' faults, constructing "yes, but" refutations that minimize specific faults and link virtues to imperfections within integrated, more general mental models (e.g., "*Yes, sometimes she gives too much unwanted advice, but she's a great listener"*; cf. Murray & Holmes,

1999). It is possible for the current study that negative characteristics were being activated during interactions with ambivalent friends, yet the negatives were linked to positive characteristics that in essence cancelled out the negativity that is often associated with heightened cardiovascular reactivity. This study highlights the need for more work on cognitive structures and implicit cognition in health-related contexts.

An emerging model of implicit social cognition describes different underlying memory systems that contribute to implicit social processes (Memory Systems Model; Amodio & Ratner, 2011). This model suggests that information stored in the semantic memory system manifests behaviorally through verbal responses and overt judgments. It would be interesting to look at the taped conversations between friends to see if there are differences in posture, uncomfortable or friendly behavior, and the tone and content of what was said during the negative event discussions. Prior work shows that explicitly rated ambivalent friends engage in more negative behaviors, such as criticism, and less emotionally supportive behaviors (Reblin et al., 2010). Future work can determine whether these behaviors correlate with implicit measures and, if so, whether the implicit assessment explains unique variance in overt behavior that could help describe some of the more health-relevant findings related to patterns of reactivity during interactions with certain types of people.

There are several general issues that warrant attention and discussion. First, in only collecting data on six friends, we likely lacked variability on the implicit measures given it was done within subjects and this may have decreased power to detect important differences. There may also have been a problem with sampling bias. Because some study groups were harder to recruit than others, we may have only gotten extreme cases

of specific categories (e.g., not the "typical" supportive or ambivalent tie). This may be the case for the explicitly supportive/implicitly supportive category, as this was the second most difficult group to recruit next to explicitly ambivalent/implicitly supportive. As discussed above, we may have also gotten participants who were compartmentalizing or had constructed more "yes, but" refutations than previous samples. In addition, prior work only randomized based on an explicit category, selecting the friend that best fit the randomly assigned condition (e.g., supportive). However, the current design required not only satisfaction of an explicit category for randomization, but an implicit category, as well. So even if the friend who was the "most typical" in the explicitly supportive category was first chosen (e.g., in the explicitly supportive/implicitly supportive condition), we then had to examine the implicit positivity in that relationship. If for some reason the first friend did not have the highest implicit positivity ratings, we then looked for the next explicitly rated supportive friend who had greater implicit positivity. The current randomization model thus required additional implicit criteria be met that would not have constrained previous explicit-only randomization models. Again, it is possible the current study sampled a whole new "type" of ambivalent and supportive ties than prior work.

A measurement-related issue is that the GNAT is structured such that participants are required to respond to both good *and* bad words in relation to their friend. This "forced" association between both good and bad characteristics would not be part of the negative event discussion. During the discussion, participants would only be responding to their friends in relation to what friendship characteristics were currently active in memory. It is possible that during the GNAT, when being forced to associate their friend

with both good and bad words, we were able to assign the friend to an implicit relationship category; however, when interacting with the friend during the discussion, the types of characteristics activated during the GNAT were not necessarily the same ones activated in the discussion context. Thus, the implicit assessment may not have always tapped into cognitive processes functioning during the discussion. Additionally, while the test-retest reliability of the SRI is high, for this particular GNAT test-retest reliability is unknown. Although we tried to minimize the time between sessions, it is possible the implicit relationship quality measured at the first visit was different from the implicit relationship quality at the second visit—especially for ambivalent ties. It is unknown to what extent participants may have viewed ambivalent friends in a more positive light for the simple fact that the friend agreed to participate with them in the study. If participation was perceived as the ambivalent friend doing them a favor, this may have influenced implicit relationship quality and underscores the importance of getting implicit assessments at both visits to determine stability of categorization.

Future work should perhaps be directed towards the context of the situation of interest (e.g., supportive context, everyday context, etc.; cf. De Houwer & Moors, 2010) and situation-specific attributes of that friend's cognitive structures. As has been done in prior explicit work (e.g., Holt-Lunstad et al., 2007), utilizing an implicit assessment that gets at the participant's cognitive structures related to the friend in the particular context to be examined in the laboratory task, rather than just in general, may be useful. It is also still unclear how the implicit assessment should most meaningfully be scored. The current study used error rates, but some studies looking at romantic relationships have used response latencies or utilized signal-detection theory to calculate d prime scores

(e.g., Lee et al., 2010; Scinta & Gable, 2007). Due to a programming error, the current dataset was missing 25% of participant "miss rates" necessary to calculate d prime, and response latencies were not captured.

It is possible that implicit measures tapping alternative automatic processes may also produce different results (cf. De Houwer, 2009; De Houwer & Moors, 2010). Similar to the IAT, while the GNAT can be considered implicit in the sense that the size and direction of its effect is difficult to control, it may not be implicit in the sense that participants are necessarily unaware of what general attitude it measures (see for evidence of awareness on IAT Monteith, Voils, & Ashburn-Nardo, 2001). The most common mistake participants in the current study would make while first learning the GNAT was thinking they should press the spacebar if they thought a word *described* their friend (rather than if it was a target word for that block). Many participants were already suspecting the GNAT was measuring something related to opinions of their friends, and it is currently unknown whether this partial awareness/suspicion influenced how they performed on the task, with implications for the assessment's predictive validity. Utilizing different types of implicit measures that function at levels involving less awareness of the target may provide a more valid attitudinal measure.

As work continues in this new field of implicit social cognition, standardized procedures and scoring will need to be developed if we wish to compare results across different studies and implicit assessments. It will also be important to determine whether implicit relational attitudes matter in the complex relationship between social ties and health. It is possible that while implicit attitudes may guide thoughts, feelings, and behaviors (e.g., future relationship dissolution), they are not powerful predictors of

disease or disease processes. As mentioned above, there are likely some methodological issues that need to be worked out before these larger questions can be answered.

Just like many of our personal relationships, the links between social relationships and health are complicated. While it is clear that relationships influence health and mortality in a variety of ways, the association is complex and may involve variables not yet considered in contemporary models. The current study examined whether implicit friendship attitudes explained variance in cognitive appraisals and cardiovascular reactivity during a negative event discussion. While implicit friendship attitudes may not have been very influential on appraisals and reactivity in the current study, we were able to break ground in an area that deserves first, attention to some of the methodological issues of measuring implicit relational attitudes, then finally a fair test of these implicit process on health.

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